Queensland Government

DEPARTMENT OF NATURAL RESOURCES AND MINES

Mine Safety and Health - Explosives Inspectorate

Explosives Act 1999

INVESTIGATION REPORT

TO

CHIEF INSPECTOR OF EXPLOSIVES

on the **AMMONIUM NITRATE EXPLOSION**

at

Angellala Creek, Charleville Queensland Australia

on 5 September 2014

File Reference: TT 14 2157

Version 2 - 29/06/2016

Prepared by	Accepted by
sch4p4(6) Personal information	sch4p4(6) Personal information sch4p4(6) Personal information
29/06/2016	29 Jun 2016
Ryan Brogden Principal Inspector of Explosives	Noel Erichsen Chief Inspector of Explosives

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List of changes from version 1

Reference	Description of Change
Chapter 4	Title changed from "Introduction" to "Background"
Section 4.1	Title changed from "Background" to "Company Information"
Section 5.7	Paragraph 5 the year 2014 was added after the text "At 1225 on 7 September…"
Table 10	The heading in the last column of Table 10 was changed from "**Colour coding for Figure 9**" to "**Colour coding for Figure 39**"
Section 7.5.2	Paragraph 2 the scenario number 6 was changed to 5
Figure 44	The order of photographs in Figure 44 was changed to be correctly described by the figure title
Section 7.5.3.4	After the first paragraph, the following sentence was added "Extract from record of interview:"
Figure 53	In the heading for Figure 53, the sample "RB10" was changed to "RB010"
Section 7.6.2.3	Paragraph 2 the word "sch4p4(7)(1)(c) Business/commercial/professional/financial affairs" was removed and the text was changed from "It is highly likely these elevated levels of sch4p4(7)(1)(c) Business/commercial/professional/financial affairs **nitrite**, chloride, calcium and iron are attributed to the soil contamination." to "It is possible these elevated levels of sch4p4(7)(1)(c) Business/commercial/professional/financial affairs **nitrite, chloride, calcium** and iron are attributed to the soil contamination, however further analysis would be required to confirm."
Section 7.7.4	A new paragraph was added to the end of 7.7.4 that stated "An estimation of the crater dimensions was determined to be approximately 6 metres across the creek bed, 12 metres along the creek bed and 5 metres below the creek bed. An accurate measurement of the crater was not possible as significant rain on 6 and 7 September 2014 filled the creek and the blast crater, destroying the original profile of the crater."
Figure 58	sch4p4(7)(1)(c) Business/commercial/professional/financial affairs

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Review of Angellala Creek Nature and Cause Investigation

by Chief Inspector of Explosives 26 Mar 2016.

1. This review provides comments on the nature and cause report compiled from the complex investigation by Inspectors of Explosives that utilised technical experts and consultants.

2. I commend the investigation team for the thoroughness and quality of the report. An investigation into an explosion is difficult as many of the elements of the incident are destroyed in the explosion. The report has addressed the possible mechanisms that could have led to the explosion of the ammonium nitrate.

3. In general, the risk associated with the use of ammonium nitrate is low in production, transport and storage, however incidents in particular circumstances such as this transport accident have the potential to cause significant damage. This transport incident is a typical example of a low probability – high consequence event. The difficulty again encountered in examining this incident is that the multiple criteria present especially after a crash are varied and unique, making the pinpointing of an exact mechanism for explosives initiation very difficult. In addition the ammonium nitrate has complex hazardous properties that make the exact causal reasons for an explosion difficult to identify. It does not burn but if contaminated will burn fiercely because of its oxidising properties. Fire is a more likely hazard than an explosion.

4. The Nature and Cause report focuses on the explosive event. It does not address issues relating to the cause of the accident which is covered in the police report. The police report could not identify a reason for the vehicle leaving the road.

5. In simple terms, an explosion would not have occurred if the single vehicle road accident had not happened. The accident led to a fire, the fire was sustained and burnt for a long time (approximately 1 hour 10 minutes before the first small explosion which was followed by a second significant explosion that registered 2.1 on the Richter scale). This prolonged intense fire resulted in the melting of parts of the ammonium nitrate load, components of the vehicle including aluminium, zinc, copper and other metals which are known to sensitise ammonium nitrate.

6. The exact mechanism for triggering the explosion is not clear. However, the accident did create conditions where molten ammonium nitrate and unmelted ammonium nitrate would have been contaminated with organic material and molten metals.

7. I accept the recommendations of the report and highlight these matters from the report:

   a. The ammonium nitrate prill was found to be within specification and until the crash was a Division 5.1 dangerous good..
   b. The vehicle maintenance was not an issue.
   c. The vehicle met the requirements and exceeded the Australian Code for the Transport of Dangerous Goods by Road and Rail , Seventh Edition.
   d. The vehicle design and construction were suitable for the routine safe transport of ammonium nitrate.
   e. The presence of significant combustible material from the vehicle and the surrounding terrain may have played a role in the intensity of fire.
   f. The particular terrain, possible presence of water and the vegetated site likely contributed to pooling and mixing of organic material, molten ammonium nitrate

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and aluminium. These conditions presented opportunities for intense sustained fire, deflagration, and deflagration to detonation transition.

g. The crash site was on a remote road and therefore the exposure to persons was quite low. This remoteness added to the response time.

h. The crash site had no mobile telephone reception which caused the a delay in the fire response notification of the incident to emergency services.

i. The initial response to an accident is provided by the lone operator (driver) of the vehicle. This accident resulted in the driver being incapacitated and unable to provide a first level response to the incident.

j. The accident resulted in the safe road configuration of the vehicle being disrupted such that fuel, electrics and load segregation were not maintained.

k. The persons injured were protected from the full blast and projection hazard by the steep profile of the creek bed functioning as a protective earth mound. It was surprising there were no deaths considering the proximity of persons to the explosion and resultant blast overpressure and projections.

l. The chances of a fire communicating to the ammonium nitrate after a crash are greatly increased and while it is not feasible to create a transport configuration that can defeat all crash scenarios there are some issues that can be addressed.

8. A public release report is to be prepared and placed on the department website. Once completed, the department will host an inter-agency review to see what collective learnings can be applied from the report. This review will include Queensland Police Service, Queensland Fire and Rescue Service, Department of Transport and Main Roads, Workplace Health and Safety and the Department of Environment and Heritage Protection

9. I favour the consideration mentioned in the report of using Layers of Protection Analysis (LOPA) to review the controls in preventing a fire, reducing the fire intensity, isolating the fire and stopping the contamination of ammonium nitrate as well as other design considerations. LOPA would be effective in dealing with complex risks associated with ammonium nitrate incidents in a structured way with a number of independent protective layers (IPL) that would require all IPL to fail to have the high consequence event.

10. A number of meetings will be held with relevant industry groups to discuss implementation of the recommendations. The fundamentals to be addressed through the recommendations will improve safety outcomes.

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26 March 2016

N.L.Erichsen

Chief Inspector of Explosives

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Donovan left Brisbane, arriving in Charleville at 2130 on 6 September 2014 and were briefed by Inspector Lionel Gainey and Inspector Bruce Symmans (Annex 31).

On the morning of 7 September 2014, Inspector Lionel Gainey and Inspector Bruce Symmans travelled to the incident site at 0600 to provide assistance to QPS and QFES. The traffic incident site was still under the control of the QPS when Inspectors arrived. Police were maintaining a cordon on Mitchell Highway 500 m to the north and south of the incident site.

Inspector Ryan Brogden and Inspector Chris Donovan attended a briefing at 0730 on 7 September 2014 at QFES Charleville with QPS and QFES officers. Due to the site safety risk, control of the site was handed to QFES. It was decided that QFES Scientific Branch would enter the site to determine if it was safe for investigators to enter. Inspector Ryan Brogden and Inspector Chris Donovan travelled to the incident site, arriving at 0930 on 7 September 2014.

At 1225 on 7 September 2014, QFES Scientific Branch declared the site safe for entry and allowed access for the Explosives Inspectorate to begin the site investigation. At 1245 a number of people from QPS, QFES and the Explosives Inspectorate accessed the incident site and took photographs and site observations.

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Observations taken at this time included:

1. Upon approach to the site from the north, the roadway was littered with dirt, tree branches, and large concrete and steel pieces.
2. A Type 1 road train was parked off the roadway to the left hand side about 400m to the north of the road bridge.
3. A fire truck was positioned in the left side lane facing south toward the bridge which had extensive structural damage.
4. A second fire truck positioned on the right side of the roadway closest to the bridge facing south also showed extensive structural damage.
5. The left side bridge guard rail was damaged with its mounting posts flattened horizontally facing towards the bridge.
6. Adjacent to the damaged guard rail medical equipment, a blanket and a dried pool of blood were found.
7. The road bridge showed extensive damage with collapsed decking covered in dirt and metal debris.
8. The centre bridge deck was to the west of the bridge under the adjacent rail bridge.
9. The rail bridge to the west of the road bridge showed extensive damage, including cracked piers and dislodged rail lines.
10. A large tree to the east of the bridge approach showed impact damage and was smouldering around its base.
11. White pieces of IBC bags were present around the base of this tree.
12. To the south, across the creek, there was a large blast crater.
13. Beyond the crater were the blackened structural remains of the prime mover.
14. Under a collapsed bridge deck smoke was rising which had a strong chemical odour.
15. A Type 2 road train could be seen to the south of the bridge parked in the left side lane facing north.

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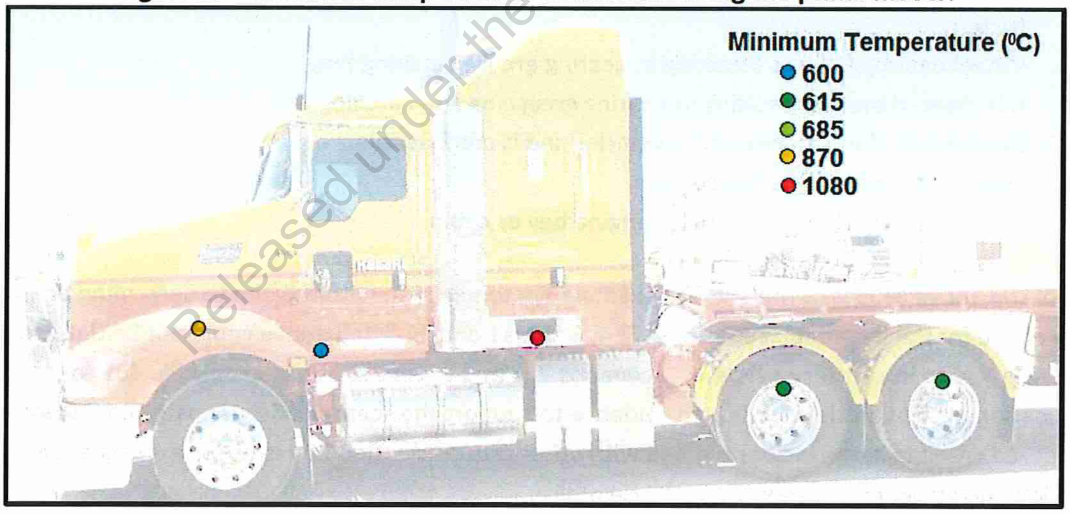
7.4 Temperature profile of fire across the vehicle

Samples of metal components from the vehicle were selected and analysed to confirm the temperature profile along the vehicle (Annex 70, 71 and 72). It is likely the maximum temperatures measured were reached as a result of the fire before the explosion. Table 10 and Figure 39 show the temperature profile along the prime mover and the first trailer (Annex 25). Different temperatures were reached across the prime mover, the highest being around 1080 °C. These temperatures are near or in excess of the melting point of copper (1080 °C) and aluminium (660 °C). Different temperatures were reached across the first trailer, the highest being around 685 °C. This temperature is in excess of the melting point of aluminium (660 °C).

Table 10 – Temperature ranges for samples analysed.

Sample #	Description	Estimated Minimum Temperature Range (Average) (°C)	Colour coding for Figure 39
TKC1	Molten metal found in chassis rail (Ex Engine Mounting)	550-650 (600)	Blue
TKC4	Rims on both rear axles (Sample from another rim that didn't melt)	580-650 (615)	Green
TKC6	Axle U-bolt (Unknown axle) on 1st trailer	650-720 (685)	Light Green (Not shown in Figure 39)
TKC8	Molten battery cable	1080	Red
TKC10	Failed injector pipe	870	Yellow

Figure 39 – Minimum temperatures determined along the prime mover.



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From the observations and analysis it can be confirmed that:

- the fire burned for over one hour
- the fire was very intense for a sustained period of time
- a significant amount of combustible material on the truck has burned
- the prime mover and first trailer sustained significant heat, reaching temperatures in excess of 1000 °C on the prime mover and up to 720 °C on the first trailer
- molten copper and aluminium were found at the site in proximity to the prime mover

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7.5 Discussion regarding the cause of fire on the Kalari vehicle

7.5.1 Vehicle fire

It is highly likely that the prime mover caught fire between it impacting the bridge guard rail and coming to rest in the creek bed. The prime mover and first trailer have been engulfed by fire. The fire intensified over a period of time causing extensive fire damage to both the prime mover, first trailer and a quantity of the ammonium nitrate load. It is likely the fire would have consumed a volume of the ammonium nitrate prior to the explosion, either from mixing with combustible material or from decomposition due to heating.

7.5.2 Known heavy vehicle fire causes

The following is a summary of common causes of fire on heavy vehicles (Annex 79):

1. Arc on ignition or battery cable or the positive feed into the cabin igniting combustible material.
2. Flammable material contacting the turbo charger or the exhaust.
3. Rubbing of fuel lines that result in leaks and then a fuel mist in the engine compartment.
4. Turbo charger failures that cause excessive temperatures in the exhaust.
5. Electrical arcs at terminals or connectors resulting from hot terminals that cause insulation to melt and catch fire.
6. Addition of heavy add-on loads onto a circuit not intended for it. If the fuse rating is increased, the wiring may not be adequately protected.
7. Tyres catching fire because they are deflated or are rubbing on hard surfaces creating friction.
8. Wheel bearing failures resulting in bearing grease catching fire.
9. Overheated brakes resulting in bearing grease or tyre catching fire.
10. Road debris that catches under vehicles and is combustible.
11. Engine oil contacting a hot surface.
12. An electrical fault in the vehicles engine bay or cabin.

Each of the above causes of fire shall be examined in this section with the aim to determine an initial cause of fire for the incident. Scenarios 2, 3, 4, 6, 10, 11 and 12 listed above could not be determined as a cause due to insufficient evidence. Scenarios 7, 8 and 9 were considered unlikely due to examination of the vehicle showing no evidence to support the scenario. Scenarios 1 and 5 were considered credible in the incident, along with other causes identified by external experts engaged to review the evidence to determine a cause of fire.

Many of the scenarios above will occur during normal operating conditions due to mechanical failure. It should be noted that when a vehicle crash occurs, the likelihood of a vehicle fire increases, due to the possible damage to electrical wires and the rupture of fuel tanks.

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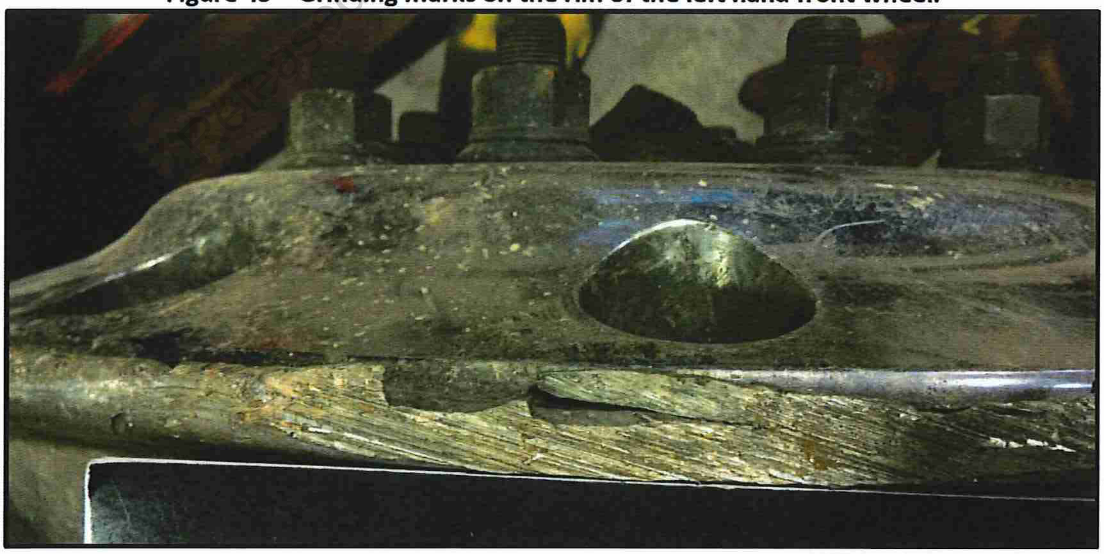
Figure 44 – Copper cable showing (a) pulling and stretching (b) separation from battery terminal.

7.5.3.3 Friction with fuel source

The left hand front wheel rim showed signs of grinding on the edge of the rim (Figure 45). These marks are at an angle of about 15 degrees to the direction that the wheels would normally be travelling on a straight road.

The aluminium has a relatively low melting point of about 660 °C. An auto-ignition temperature of 760 °C has been reported for aluminium powder. Potentially the powdered/molten grinding products could have ignited from friction experienced during the process of grinding the rims.

Figure 45 – Grinding marks on the rim of the left hand front wheel.



With the presence of diesel it is possible this may have been an ignition source for a fire. Given the location of the diesel tanks and expected speed of approximately 90 km/h that the truck was

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travelling at the time of the crash, it is unlikely that diesel would have been in the vicinity of the tyre rim while the heat was sufficient to cause auto ignition of the diesel (i.e. above 240 °C). Hot and molten grinding products could have travelled back towards the location of spilt diesel fuel. See section 3.2 of the report by Inspector Theo Kahl in Annex 25 for a further description.

7.5.3.4 Other possible causes of fire

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7.6 Scientific testing by Queensland Health Forensic Science Services

7.6.1 Samples of ammonium nitrate

A number of ammonium nitrate samples were collected from the incident site in the days after the vehicle crash and explosion. These samples were collected from visual observation of substances that appeared to be ammonium nitrate or melted ammonium nitrate that had recrystallised.

Samples of the ammonium nitrate manufactured at the Orica Yarwun plant were collected from the same production batch runs (28 August to 2 September 2014 and 2 to 6 September 2014) to the ammonium nitrate involved in the incident.

Table 11 details the ammonium nitrate samples collected from the Angellala Creek site. Figure 46 shows the location each sample was taken from at the Angellala Creek site. The last four entries in Table 11 details the exemplar samples taken from Orica Yarwun and an Orica storage site at the Cudeco Mine in Queensland.

All samples were sealed in plastic buckets or bags and later sent under continuity receipts to

Figure 53 – Ammonium nitrate samples RB010, RB011 and RB012 under prime mover (white areas).

Figure 54 – Ammonium nitrate sample RB008 near bridge on southern bank (white areas).

A series of soil samples were collected from near the blast crater at locations away from potential contamination from the ammonium nitrate on the vehicle, the fire or subsequent explosion. These soil samples were used for comparison purposes to the ammonium nitrate samples collected and contaminated with soil. Table 12 details the location from which each soil sample was taken.

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Table 14 – Rainfall measured from nearby Bureau of Meteorology weather recording stations.

Station name	Distance from Incident site	Station number	Latitude	Longitude	Elevation	Rainfall total 6-8 Sept 2014
Bakers Bend AL	14 km	044233	26.71 °S	146.11 °E	261 m	11.4 mm
Charleville Aero	28 km	044021	26.41 °S	146.26 °E	302 m	7.6 mm
Binnowee AL	16 km	044230	26.48 °S	146.09 °E	200 m	39 mm

7.6.2.3 Results of analysis of samples from the incident site

The results of the contamination of ammonium nitrate samples collected from the incident site are detailed in section 13.3 of the QHFSS report (Annex 74). The results for samples A, B, C and B004 located on the northern bank adjacent to the tree that the vehicle hit show no contamination of the ammonium nitrate by inorganic or organic substances.

There are some slight elevations in the amount of [redacted] nitrite, chloride, calcium and iron for some samples analysed (Item C, sample 3; Item E, sample 1; Item RB009; Item RB10, Aggregate; Item RB011, Prill), however these correlate with a significant amount of insoluble material contaminating the sample (i.e. soil/ground substrate, described in section 13.2 of the report in Annex 74 as sand and/or clay and/or black carbonaceous material) of between 15.70 to 25.13 % across these samples. It is possible these elevated levels of [redacted] nitrite, chloride, calcium and iron are attributed to the soil contamination, however further analysis would be required to confirm.

Sample A also shows an elevated TOC level, described in the report in Annex 74 as being due to the minimal amount of material available for the TOC analysis, being heavily contaminated with soil and plant matter that could not be separated from the ammonium nitrate and having only single replicate analysis. This TOC result provided in the QHFSS report for Sample A is considered invalid and is therefore not considered as part of the results in this discussion.

Sample D and E appeared to be a recrystallised form of molten ammonium nitrate with significant contamination of an unknown origin. These samples were found in the area of ground where span 4 of the road bridge adjacent to the blast hole was located prior to the explosion (Figure 46). After the explosion span 4 of the bridge was no longer in its original position.

The results for sample D and E (Annex 74) show increased levels for copper and zinc. The source of the copper and zinc is likely from the Kalari vehicle involved in the fire. There are no other known sources of these metals that were in proximity to the load of ammonium nitrate. The temperature of the fire on the prime mover and evidence (Annex 25) confirms that both copper and zinc from the prime mover or trailers would have been in the molten phase and could have mixed with the molten ammonium nitrate.

Samples D and E (Table 13) also indicate the presence of diesel type (distillate-range) hydrocarbons that would be consistent with diesel and differentiated from the heavy mineral oils, waxes, long

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What is not well understood in the literature is the initiation method for the detonation to occur. It is possible a small explosion in the gassed and molten ammonium nitrate has occurred, leading to a larger explosion of the hot solid product and then the ambient temperature product. In normal explosives use this is referred to as the explosives train, i.e. a small initiator detonates a sensitive and powerful explosive charge that detonates the large insensitive explosive.

The initiation of the explosion could be caused from the following (Annex 75):

- Shock to detonation transition or impact (SDT) to molten ammonium nitrate with sufficient energy
- Deflagration to detonation transition (DDT)
- Interaction of molten ammonium nitrate with molten metals such as aluminium, zinc, copper (possibly forming tetramine cupric nitrate complex) and chromium creating a very sensitive explosive

These scenarios are difficult to replicate in experiments and while attempts have been made, initiation of ammonium nitrate via these mechanisms has not been consistently achieved and the quantities used in experiments have been very small compared to the quantities involved in actual incidents.

7.7.3 Analysis of first explosion at Angellala Creek

The first explosion occurred at approximately 2210 and was described by witnesses as having no overpressure shock (Table 9). This may indicate the explosion was not large or did not involve a detonation. The first explosion was described as having bright white sparks burning and slowly falling from the sky following the explosion; described as a firework effect. This is possibly due to burning metal, such as aluminium, or another combustible material that was thrown into the air from the explosion.

The cause of the first explosion is unknown. There was no evidence found at the site that could be linked to this first explosion. A number of scenarios have been considered for the first explosion and they shall be described briefly. No further analysis was conducted due to the lack of physical evidence. The possible scenarios include:

1. A pressurised piece of equipment (for example a tyre or air receiver) has burst possibly as a result of fire and thrown molten or burning debris into the air
2. A gas or thermal explosion from the decomposition of ammonium nitrate has caused a low order explosion
3. There has been an explosion involving ammonium nitrate that has been small and not involved the larger load of ammonium nitrate
4. Molten aluminium contacting either a water source or molten ammonium nitrate causing an explosion (Annex 85)

7.7.4 Analysis of second explosion at Angellala Creek

The second explosion occurred at 2212, confirmed by Geosciences Australia as reaching 2.1 on the Richter scale at the location of the explosion (Annex 86). The explosion was catastrophic. The Kalari vehicle involved in the crash was destroyed, along with the road bridge. The vehicles in near vicinity

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to the explosion were significantly damaged. The people near the explosion were seriously injured, sustaining blast type injuries from the overpressure blast wave and projected blast debris.

The explosion consumed the ammonium nitrate remaining after the vehicle crash and fire. It was estimated from observations at the site that approximately 6 to 8 IBCs (7.2 to 9.6 t) of ammonium nitrate were dislodged from the trailers during the crash. Five part IBCs with ammonium nitrate were found near the tree that the vehicle hit during the crash. Some of this material had burned with combustible material over a 24 hour period following the vehicle crash and only small amounts of ammonium nitrate were collected from the IBCs.

Ammonium nitrate was also spread across the site in a fine layer as a result of the crash. During excavation of the surface of the creek bed under the bridge, this layer of ammonium nitrate was found about 100mm below the soil that was ejected from the blast crater and deposited over the area surrounding the blast crater following the explosion (Figure 16). Bags containing small quantities of unburnt prill were found during excavation near the tree hit by the vehicle (Figure 52).

The fire that burned on the vehicle would have consumed an amount of the ammonium nitrate due to decomposition into nitrous oxide gases when heated above the decomposition temperature of 210 °C. Given that some metal parts of the trailer were measured as having reached a temperature in excess of 600 °C, it can be reasonably assumed part of the ammonium nitrate load would have exceeded the decomposition temperature.

Based on the loss of ammonium nitrate from the vehicle during the crash, there may have been approximately 40 to 45 t of ammonium nitrate left on the trailers from the original 52.8 t following the crash.

It is likely ammonium nitrate was in contact with or very close to the first trailer and the front half of the second trailer, as the remains of these parts of the trailers were scattered across a 1 km radius from the blast site. Most of these trailer components showed significant fire and blast damage. The rear half of the second trailer was not affected by fire and was still mainly intact, with the rear two axles and suspension still attached (Figure 27). The aluminium decking was missing from this part of the trailer. This would indicate that the quantity of ammonium nitrate and the blast pressure was not as significant on the rear of the second trailer. There were no recognisable parts of the converter dolly found. This indicates the dolly may have been near the middle of the blast and small parts of the dolly were scattered across the wider site.

It is thought that part of the load of ammonium nitrate may have been under and around the rear of the prime mover before the second explosion, as this rear differential was found 170 m south east of the blast site. This rear differential weighs approximately 1300 kg and would require significant energy to be projected that distance.

Based on an observation of the blast crater, it is possible that the two trailers were overlapping each other (Figure 56). A detailed analysis of the blast crater profile was not undertaken as this is unlikely to provide an accurate assessment of the orientation of the load prior to the explosion or an accurate assessment of the size of the explosion.

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An estimation of the crater dimensions was determined to be approximately 6 metres across the creek bed, 12 metres along the creek bed and 5 metres below the creek bed. An accurate measurement of the crater was not possible as significant rain on 6 and 7 September 2014 filled the creek and the blast crater, destroying the original profile of the crater.

Figure 56 – Blast crater with original creek bed profile in top left.

7.8 Assessment of blast effects

The estimation of the blast size based on crude analysis was between 10 to 15 t of TNT. In Queensland, the acceptable TNT equivalence for ammonium nitrate is 0.32. Based on this TNT equivalence, this would equate to a mass of 31 to 47 t of ammonium nitrate involved in the explosion. This correlates to all of the expected mass of 40 to 45 t of ammonium nitrate that was anticipated to be in the blast crater being consumed in the explosion.

It is astonishing there were no fatalities as a result of the explosion. Five of the injured were in the open, approximately 50 m to 60 m away from the blast. One person was in the open and one person in a fire vehicle approximately 70 m away from the blast. Another person was approximately 200 m away inside a police vehicle. Considering the injuries sustained, it is estimated that they received a blast overpressure of 21-70 kPa, based on 70 kPa being considered a 100% chance of fatality to a person in the open (Annex 87). If the Kalari vehicle was in direct sight of the people 50-60 m from the blast, it could be assumed that most of the seven would have been killed.

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Figure 58 – Vehicle repairs undertaken on prime mover involved in the incident.

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7.9.3 Initial emergency response guide

An initial emergency response guide, SAA/SNZ HB76:2010 *Dangerous Goods – Initial Emergency Response Guide* (HB76) is a guidebook for first responders responding to a dangerous goods or hazardous materials transportation incident. It is used by the driver and emergency response personnel such as firefighters. Chapter 11.2 of ADGC requires emergency information to be carried by a vehicle transporting dangerous goods that may include HB76.

One of the initial actions when responding to a vehicle fire involving its cargo is to identify what the product/s are on fire or imminently involved in the fire to determine what hazards are posed by the load so appropriate precautions can be taken.

Following this incident, QFES have undertaken a review of the HB76 Guide 50 that details the requirements for responding to an ammonium nitrate incident. These changes have been submitted to Standards Australia for an update to HB76 (Annex 90).